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## OPHTHALMOVASCULAR CHOKE.

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For over 50 years many thousand oculists have been examining the eye-grounds of millions of patients with the ophthalmoscope, and in a certain large proportion of these patients these oculists have looked at several abnormal or morbid phenomena. But they have not seen that these things were morbid, and without an inquiry as to their significance they have been classed as physiologic, causeless, and resultless. For 20 years I had been as guilty of malobservation and thoughtlessness, but my excusing of myself is based upon the fact that I had supposed that these thousands of "scientific" men and "surgeons," would not have overlooked glaring, gross, and naked-eye abnormalisms, and that the significancies of the morbid facts, facts which were plainly seen of all, would have been set forth in all the text-books of 50 years. This is especially true when one thinks how long and avidly the entire ophthalmic world has sought for the etiology of glaucoma, pigmentary and atrophic degenerations of the retina, etc., which still remain vexatiously mysterious. A cause that lessens or shuts off the ingress or egress of the retinal blood-supply seems at once to solve the problems.

One of these facts is pulsation in the veins upon the nerve-head or papilla. Where else in the whole body is there a pulse-beat of veins? The fact itself is an abnormalism, and should have aroused instant suspicion, and a study of its possible significance. Its immediate cause was of course understood: the venous blood could only find exit between the beats of the arteries crowded against the veins. But why the crowding? And was not the diminished outflow itself morbid? And were there no resultant and secondary failures

[101] in nutrition, *i. e.*, impaired visual functions, etc.? These and like questions were not asked.

Another constant and daily revelation of the ophthalmoscope has been crossings and pressures and windings of the retinal arteries and veins under, over, and about each other, and, more rarely, even of a single trunk about or across itself. In many, perhaps the majority of such crossings, twistings, etc., the lumen of the vessel may not be lessened and the flow of blood either to or from the capillaries may not be patently hindered. But in a certain number of cases the underlying vessel is plainly flattened, even closed, and the caliber and size of the whole tube after the crossing strikingly lessened or almost extinguished. There follows the inevitable diminution of the amount of blood flowing by the constriction. Such phenomena, in default of a better name I have ventured to call "Ophthalmovascular Choke." It is of course a truism of physiology that perfection of physiologic function requires perfection of inflow and outflow of blood. The higher the function, the more complex the structure, the greater the necessity for a faultless blood-supply.

In a noteworthy physiologic study, by Dodge, of Visual Fixation, there are manifold accurate proofs that, speaking absolutely, any exact or persisting macular response to the [102] image-stimulus hardly exists. The study takes no note of pathologic conditions, but every expert oculist knows how much more striking is the shortness and inconstancy of visual fixation with eye-strain, amblyopia, inflammations, etc. I have elsewhere made a study of over a dozen mechanisms producing shadings of the retina, and which help to reestablish the sensitiveness impaired by too much light, by the overlong or even by a short exposure of the retinal sensitive plate, etc. It goes without saying that this easily exhausted sensitiveness will give way quicker if the full supply of fresh blood is lessened in any way. The false, blurred, or imperfect image of ametropia, of course, also increases the difficulty of the retinal labor. The sharp limits as regards the length of time of the response of the normal retinal function to the exposure of one image are quickly shortened or made morbid by many factors. The study and delimiting of these factors would, in truth.

serve as a measure of the subnormality of general ocular [102] function.

There is one symptom of subnormal retinal function which has been impressed upon my attention for many years. I have probably noted it in my case-records hundreds of times, but from apparent negligence I failed to recognize its true nature and amazing significance. From the first I have named it, *Fading Image*. Up to the last year I was so dull as not even to measure the length of time during which the image could be held, *i. e.*, the time from opening and fixation until the fading of the image or the failure of sensation began.

One further preliminary: Amblyopia *per se* may beget the symptom of "fading image"; but when visual acuteness has been retained; when perfect correction of ametropia has been secured; and when the plainest, most severe, and most direct symptoms of ocular malfunction persist; and especially when as sometimes they persist after other more severe local and systemic diseases have at once ceased with the wearing of scientific spectacles,—then, other diseases having been excluded, there must arise the suspicion of some more occult pathogenetic factor in the eyes themselves. Such, more or less, were the conditions existing in the ten cases I shall briefly describe. The manifest existence of eye-strain symptoms after perfect correction of ametropia, with "fading image," plus the equally manifest ophthalmoscopic demonstration of "Vascular Choke," brought to view a new disease, which I cannot help feeling is of too great frequency and significance.

CASE I.<sup>1</sup>—For most of her life a highly intellectual and non-hysterical woman, 46 years of age, had suffered abominably from evident eye-strain. A number of the best oculists of the United States had failed to cure her with the best glasses and treatments they could suggest. The worst diagnoses and treatments (general paresis, said one brutally and erroneously), tenotomies and despair, the woman had wisely refused to illustrate or assent to. I was to be the last oculist consulted. But my glasses, etc., did no more good than those of my predecessors. At the first visit in using the ophthalmoscope I spoke of a curious loop in the

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<sup>1</sup> The first two of the following cases are epitomized from reports of my first article upon the subject in the *Medical Record* of June 1, 1907.

[102] superior temporal artery of the right eye. The patient said: "Oh, everybody has noticed that," but adding that it had no significance. The artery close to the disc turned upon itself, forming a circle about 10° in diameter, and passing under itself proceeded onward toward the macula. But in passing beneath the vessel was flattened by the pressure of the vessel about it, and from that point the artery was pale, half collapsed, and evidently carrying but a small quantity of blood. The macula was stippled and somewhat morbid in appearance, but otherwise the eye-ground seemed normal. My glasses had given no relief; there was a decided tendency to shut the right—the naturally dominant and important dextral eye—out of function; no device had given hope; the subnormality of accommodation of the right eye was about 1 D. greater than in the left eye—a significant fact; the amblyopia had not bettered under proper glasses; the symptoms, partly those due to eye-strain, were so peculiar as to arouse suspicion that more than ametropia was the matter,—such were the conditions which directed attention to the hitherto neglected looping of the upper macular artery, and the plainly lessened blood-supply of the retinal area supplied by it. I at once ordered a blinder worn nearly constantly before this eye. A more certain test would have been a bandage, because, according to the physiologic law of imperative function, the right eye must struggle for life and dominancy during all the years it is dying. In a few weeks the report was that while there was not by any means complete comfort, there had been a decided lessening of the severity of the pain, etc. The most significant fact was this: While the blinder was worn there was comparative freedom from pain, etc., but when it was removed a throbbing pain came on, which did not disappear until the blinder had been worn again for an hour. I then knew my theory was correct and that there was nothing left but to exclude the ailing eye from function. A large black lens was provided to be worn absolutely constantly, and relief was soon secured. After a life of excruciating suffering the patient wrote (a year after first consulting me): "I am sure it will gratify you to know that my eyes are relatively comfortable; the blinder is a lasting success." Eloquent testimony to the reality of the suffering and also of the cure, is shown by the willingness and necessity of wearing the hideous blinder all the time.

CASE II.—There had been failure of seven oculists, the last myself, to relieve a healthy strong young man of 20 years of age of "inability to use his eyes." His greatest complaint, upon persistent questioning, is that he becomes suddenly blind, or nearly so, when looking at anything. Things fade out and become nearly and wholly invisible. Even in the street, in looking at a person, the bodily figure grows dim or invisible; when playing

baseball, and watching the course of the ball in the air, it will [102] disappear for a second or more and then again become visible. In order to see anything plainly he has to rub his eyes. In near vision it is more impossible to hold the image. The peculiar and persistent blepharospasm for twelve years, with the rapid fading of the image, seemed to point to difficult holding of the retinal function due to faulty blood-supply. Competent general physicians had examined him and pronounced him free from all recognizable systemic or organic disease.

Having in mind the case above described, I was quick to recognize the existence in this man's eyes of the anomalies of the network of the retinal veins and arteries. From the point of emergence or entrance at the disc they curled about each other, crossed and recrossed each other, in a manner to strike immediate attention. Description would be almost impossible. The upper temporal artery of the right eye crosses over the vein on the disc, and crosses under the vein twice after leaving the disc. The lower temporal artery crosses over the vein on the disc and does not recover full size and color for  $30^{\circ}$  below the disc. The upper temporal artery of the left eye passes over the vein on the disc, again passes under the vein on the disc, and once more passes under the vein about  $40^{\circ}$  from the disc. The lower temporal [103] artery passes beneath the vein on the disc, passes over the vein  $20^{\circ}$  from the disc; and again over the vein  $40^{\circ}$  from the disc. The arteries are smaller and thinner and lighter in color on the disc than toward the periphery, whereas the veins are turgid and swollen as they approach the disc. There was noteworthy general venous stasis, and venous pulsation was present. Both eyes were affected in the same way, but the right possibly in a more decided manner. I felt justified in ordering correct lenses, in explaining what I thought the cause of his symptoms, their incurability, and in urging a life-time renunciation of nearly all reading, writing, or near-work occupations. This advice was accepted, and after a year the reports are that the symptoms though somewhat improved still remain essentially as before, increased of course by "near-work" with the eyes.

CASE III is that of the physician's wife reported in *American Medicine*, February 24, 1906, and included in Vol. V, *Biographic Clinics*, page 115. Up to the present time the woman has been as healthy and as happy as could be wished. There is not a trace of "neurasthenia," "hysteria," "retroversion," "exhaustion," back-ache, headache, etc. But one bothersome symptom was discovered after the complete re-establishment of the general health. It was not noticed earlier because near-work with the eyes was not undertaken. During the last year it has been found that reading, writing, or sewing at once produces waves of inability to hold the

[103] vision, or the image; "things fade out" when looked at for a few seconds, and there is a great "nervousness" when the task is persisted in. The patient is compelled to renounce. This symptom, indeed, has always existed, but it was hardly noticed because of the vastly greater and more multifrom suffering, and also because "near work" with the eyes was not persisted in. Since recovery the natural desire to read, write, and sew, has become more imperative, and the inability to do so more noticeable and strange. The significance of the fact lies in the possible incidence of the symptom and the terrible results from use of the eyes in those who cannot, as can this woman, renounce labor with the eyes at near-range. Despite all attention to refraction, correction of subnormal accommodation, physical exercise, and other therapeutic advice and device the "fading image" persists. With continuous fixation of a letter or word, either at 20 feet or at 14 inches, it fades to nondiscrimination or nonvision in three or four seconds. This is with either eye alone, or both together. In reading, etc., the patient is compelled to move the gaze constantly from one object to another in order to keep on with any continuous work, and if the eyes are forced for a too long task, there is ocular pain, nervousness, evident injury, especially the next day, and then any use at all is impossible. The upper ophthalmic vein of the right eye passes under the artery at the disc, is engorged before reaching it, and empty, almost invisible, afterward. There are numerous other crossings, and venous pulsation is present. The crossings and pulsation are similar in the left. After massage of the eyeballs in the office the images were held for about two seconds longer than usual, but such massage carried out at home afterwards seemed to produce other symptoms such as headache, etc., and the patient would not go on with it.

CASE IV is that of a young man of 25, whose eyes at ten were so bad that he "could not distinguish food and dishes upon the table." Headaches attributed to constipation, troubled as a child, and there were attacks of sick-headaches, without vomiting, with pain over the right eye, etc. He has noticed that he has had to look aside constantly for an instant in order to fix any object at all persistently. The fading-image symptom was verified. He was and remains naturally left-handed, but was taught to write with the right hand. There has long been noticed "blurring of vision" with near-use of the eyes. The eyes burn, insomnia is complained of, etc. Thinking the symptoms due to his uncorrected astigmatism I ordered B. E. + Cyl. 0.75 ax. 90° for constant use. My error was more excusable because of his amblyopia, which with the best lenses was 20/40 each eye, but more marked with the right eye. I found a vascular choking especially of the right, which kept me on my guard, and made me caution the patient that if

the fading-image symptom persisted he should change his occupation to one demanding the least possible use of the eyes for near-work. This choking was manifest to me in a unique crossing of the upper ophthalmic vein of the right eye over the artery, in such a way that the vein rose over the artery in a sharp half-circle, like a letter n, the artery crowded beneath and within, and filling all the space. There was manifest choking and stasis. Similar conditions existed in the left eye, but less marked. There was long venous pulsation in both eyes, with congested and highly stippled maculas. [103]

CASE V is that of a woman of 34 whose clinical history consisted in "fading image" (spontaneously complained of), headaches, and many swooning or fainting attacks. She "had all the diseases of childhood," "remaining in a dark-room a long time," "a protracted attack of malaria," etc. Her general physician thought another long illness 15 years ago was a return of the "malarial infection," but she was cured at once by some glasses secured at the time, from a good refractionist of another city, and the "malaria" has never recurred. Whenever she did not use the glasses there was a recurrence of headaches. She has had many oculists and I found the last one had ordered R. + Cyl. 1.00 ax. 75°, L. + S. 0.50 + C. 0.50 ax. 90°, with + Sph. 1.00 added for near work. The headaches start in the eyes and extend to the occiput, have been particularly severe during the last year and a half, with nausea in the morning until she puts on her glasses. Feelings of nervousness, hurry, irritation, etc., were also complained of. She "faints away" on the least provocation. The swoonings began in late childhood, and she falls to the floor unless she hurriedly sits down when she feels them coming on. With proper correction of ametropia, the image fades in the right eye in three to four seconds. Early in the morning the image is held twice as long as after use of the eye during the day. The fading is "typical," *i. e.*, the image goes out entirely and returns completely. In the left the image is held longer and is a blurring and indistinctness rather than a full disappearance of the image. With both eyes the failing comes on in about eight seconds. Full clearness of the image recurs in about eight seconds. In the right eye there is venous pulsation, the superior ophthalmic vein passes under the artery, and afterward it is only one-half the size from this crossing until it enters the nerve. It is swollen and turgid before the crossing. There is no venous pulsation in the left, less venous clogging, seemingly because the vein passing under the artery just at the point of turning to enter the nerve, is not so much choked. While held, the visual acuteness of the right eye was at first only 20/40; after wearing glasses awhile it

[103] became nearly 20/20. The acuteness of the left was nearly normal from the first. The refraction error is:

$$\begin{aligned} \text{R.} + \text{Cyl. } 0.50 \text{ ax. } 100^\circ \\ \text{L.} + \text{S. } 0.37 + \text{Cyl. } 0.75 \text{ ax. } 90^\circ \end{aligned}$$

CASE VI is that of a robust young woman of 23, whose general health since renunciation of study, and near-work has been good. During the period of her most severe studying six or seven years ago she had a "nervous breakdown" (in the language of the lay-world,—"neurasthenia" in that of the Neurologists), and was compelled to leave school. At this time she was very "anemic," and had a score or more of "fainting spells," losing consciousness from 5 to 10 minutes at a time. Four years ago she got glasses, worn ever since:

$$\begin{aligned} \text{R.} + \text{S. } 1.75 + \text{C. } 1.00 \text{ ax. } 90^\circ \\ \text{L.} + \text{S. } 2.25 + \text{C. } 0.50 \text{ ax. } 90^\circ \end{aligned}$$

[104] Her static error I found to be:

$$\begin{aligned} \text{R.} + \text{S. } 2.50 + \text{C. } 1.75 \text{ ax. } 85^\circ = 20/30 \\ \text{L.} + \text{S. } 2.75 + \text{C. } 1.00 \text{ ax. } 95^\circ = 20/20? \\ \text{with good muscular balance.} \end{aligned}$$

With proper correction the object steadily gazed at, fades out in four seconds with the right eye, and with the left eye in six seconds, with both eyes in eight or nine seconds. She has long been conscious that she "couldn't hold the sight of things"; the symptom was worse before she got glasses, during her "breakdown," etc. It troubled her little when she wore her glasses, in after years, and was not noticed when she did not use her eyes in reading, writing, etc. Indeed it came to be her rule to wear the glasses only when the symptom became troublesome. Several months after her first visit to me and at her second visit it was as troublesome as ever, and the visual acuteness had deteriorated somewhat, because she had been wearing her glasses but little. Even then the fading image at this time would cease bothering her much whenever she resumed her spectacles. I found the vessels frequently intercrossed near and upon the discs, the lumens of those passing beneath flattened and in great part extinguished, the veins turgid, etc.; there was no marked venous pulsation.

CASE VII is that of a woman of 30, in whom frontal headache began about 9 years ago. Two years later pain in the eyes was so severe that different parts of the body, the tongue, arms, etc., seemed as if paralyzed by it (the old story again!), and continuing until the only relief obtainable was by means of morphin. The pain at the first visit to me was chiefly at the backs of the

eyes, but also in the temples, forehead, and back of the head. [104] This was constant, she was never free from it, even in the night. Whenever she tries to use the eyes she has intense nausea and a "faint feeling," and can sleep at night only if she has not used her eyes at near-work during the day. Constipation has been severe. She has lived an out-of-door life, having neither read, written, or sewed for years. "Muscular rheumatism" (mis-named!) has existed from childhood, and photophobia and epiphora have been troublesome. She was wearing B. E. + S. 2.00 + C. 0.25 ax. 180°, and had been using glasses for about six years. Her static error I diagnosed:

$$\begin{aligned} R. + S. 2.00 + C. 0.37 \text{ ax. } 180^\circ &= 20/20 \\ L. + S. 2.00 + C. 0.25 \text{ ax. } 180^\circ &= 20/20 \end{aligned}$$

with 12° of esophoria.

Her last oculist had advised tenotomy, but fortunately this was not accepted. Her general physician pronounced her disease to be "due to a neuropathic condition of the general system,—in a word a neurosis,"—the ancient modern naming of an unknown condition with a meaningless word. I ordered the above correction less 0.37, for constant use, and one year later there had been but little improvement. She lived far away and I begged her, unwise as it proved, to have thorough examinations and treatment, by the best general physicians. But these had no good result, and, after having used and disused bifocal glasses for possible subnormal accommodation, I had her make another journey to me. By this time I was on the lookout, in such cases, for the fact, and the causes, of the fading-image symptom, and at once it was demonstrated. The refraction, etc., remained essentially as before. The main trunks of all the vessels passed over or under each other several times, but there was no venous pulse. The image of either eye alone could be held for three, or at most five seconds, and with both eyes for three seconds. With attempts to hold it longer the eyes filled with tears. Any jar makes the eyes throb, and stooping produces this at once. The blurring or fading seems like a pulse-wave that comes and goes. The image is not held better in the early morning. She raises her eyes and eyebrows constantly in attempting to look at anything. She finds she dare not go to church, theater, parties, etc. She has the curious and anomalous ability and habit, when attempting to "concentrate" or fix her gaze, of raising the right and lowering the left eye, at the same instant. Her local oculist, a skilled and conscientious man, thinks the trouble comes from the esophoria, but this cannot be when the image fades with either eye used singly. I shall not consent to tenotomy, although massage and other possible therapeutic measures seem useless. The rules of life and of practical living are clearly indicated.

[104] CASE VIII.—At my request this patient wrote the following: "All my life I have had headaches, 'nervous,' 'neuralgic,' 'bilious,' or 'sick.' As a young child I would have spells of semi-blindness, followed by the tense head-pain, and finally vomiting, exhaustion, sleep, and recovery. These attacks or others, have continued at intervals, ever since. Have had neuralgia (facial, head, and eye) also. Was known as a 'nervous, fidgety child,' given to outbursts of passionate anger, nervous terror, or violent weeping. For years I had throat trouble, 'tonsillitis,' and was a persistent somnambulist. When walking in my sleep I always executed any commands given me, and had the general air and appearance of one hypnotized. I was usually perfectly conscious—but powerless to control my actions—and was filled with a nameless terror, that usually ended in a paroxysm of weeping. These occurrences are now quite rare.

"From babyhood also, I have had attacks of losing my breath. My old nurse called it 'holding my breath' and said it was temper. (Possibly because strong emotion or violent feeling of any kind brings on such attacks.) I feel smothered, faint, gaspy, dizzy,—sometimes the sensation passes off in a few minutes, especially if I can reach open air, sometimes it continues until a state of partial unconsciousness results. I never fall—(save once or twice as a child after jumping rope) but frequently feel the floor rise or sway,—and have to catch something to steady myself. These seizures were especially frequent between the ages of twelve and fifteen, and eighteen and twenty (the latter a time of great grief, and worry and stress). I have also been subject to attacks of exhaustion somewhat similar to the above; sometimes combined with them, sometimes independent,—when the prominent symptom is complete collapse, inability to speak or move, and an intense desire for silence and solitude. These latter attacks have been conspicuously frequent of late.

"My hearing has for years been abnormally acute and abnormally irritable. The ticking of a clock is almost unendurable, the buzz of voices or any constant sound, however low, nearly drives me frantic. My father exhibited the same idiosyncrasy.

"All my life I have had a tendency to flushing, the blood beating in the temporal and jugular arteries so that the pulsations are plainly visible. At such times I feel strangled. Another prominent idiosyncrasy is an insatiable thirst, which has persisted since childhood. I drink quarts of water a day, and yet my mouth and throat are at times so dry that I speak with difficulty—(I have a natural lisp anyway, and as a child, stammered. I do so now when tired or excited). Of late this thirst has been even more pronounced, and I imbibe more water than ever. I seldom drink liquor or malt beverages, and can digest but little milk. My mother could not nurse me, cow's milk nearly killed

me, so I was given to a healthy wet-nurse, and was weaned on [104] goat's milk.

"My digestion is fairly normal, though I cannot and do not, indulge in rich meats, pastry, or greasy foods. I am a good sailor, seldom get sea-sick, but from childhood have been 'carsick,' when riding on trains. It almost nauseates me to look down from a height.

"As a little girl I always winked, blinked or frowned in the sunlight, or any bright light. I had the usual children's diseases, plus two protracted attacks of malaria (never scarlet or typhoid) and the pronounced 'nervousness' previously chronicled. This prevented any regular schooling until I was twelve years old, but [105] I read insatiably all the time, in school or out.

"When sixteen or seventeen years old I developed an inflammation of the eyes which caused my mother to consult an oculist. He prescribed glasses 'for reading,' and for some time treated the eyelids with nitrate of silver. I wore these glasses for several years.

"In 1896, I developed insomnia, some digestional disturbance, and more than the usual number of attacks of faintness. The physician consulted prescribed digitalis, bromide of potassium, and hydrochloric acid (I think)—and change—I took up teaching at this time—my father's estate being hopelessly muddled, and worked and worried and grieved myself almost into collapse.

"For ten years thereafter I led a very strenuous life. I taught (part of the time both day and night), studied at the University afternoons, Saturdays, and summers, kept house, etc., and for several years there were troubloous times. Prior to this, I had had a winter of eye-symptoms; went to Dr. ——, who tinkered a long time, and then to Dr. ——, who took great interest, was very kind, and seemed to help me. I consulted him at intervals for several years.

"During the summer of 1903, I attended a summer Art School, and on my return to school work in September broke down. I then developed insomnia, and numerous other nervous symptoms. I consulted Dr. —— in September or October, 1903. The diagnosis was 'a case of nerves, due to strain and overwork, coupled with a strong hereditary, nervous tendency.' All winter I was harassed by an indescribable nausea, without vomiting, morning and afternoon. Dr. —— finally decided it must be due to a uterine misplacement, which was found to exist, along with considerable congestion. I was treated for this for some time, and at intervals ever since; for the trouble returns whenever I fall from the physical high water mark. During the summer I recuperated—had little or no nausea, etc. On my return to the city in September I developed grippe,—and then in October started on a siege of morning nausea and evening vomiting which lasted

[105] till spring, and has left an apparently ineradicable tendency ever since. The nausea and vomiting was sandwiched in with attacks of faintness, headache, giddiness, irritability, insomnia, and uterine trouble, singly and together until summer and rest brought relief. For a long time Dr. —— had ordered, entreated, cajoled me to leave school, for a while anyway. Accordingly I remained out from July, 1905, to February, 1906. There was improvement but not cure. The same old symptoms, modified, persisted less harrowing, and I had more time to recuperate in between. During this time my eyes failed again. For years I had heard oculists speak of 'spasm of accommodation.' I consulted Dr. —— who found the 'spasm,' spoke of 'an interesting case,' and after a time decided there was rheumatism of the muscles (Dr. —— had said the same) and directed Dr. —— to give me some anti-rheumatic remedy. She had done this previously on her own account, but did so again. Eyes improved for a while. Resumed school duties in February, 1906, and again my woes began. In September, Dr. S. insisted on my taking a year's leave of absence. I did so, and remained under her supervision all winter. There was gain and improvement but not absolute cure. During June, 1907, I did constant writing and my eyes gave out utterly. It was then I first wrote you. This fall the principal trouble is headache, eyeache, nausea, flushing, faintness, smothering, and exhaustion, nervous irritability, and dread of sound, and an inability to read more than a few minutes at a time—coupled with intense dread of light,—especially electric. My head feels at times as though it were being crushed, and there is pain and sensation between the shoulder blades, and from there up to the head.

"Dr. —— gave me another thorough examination last week. She says it is 'all nerves' and I must learn to help myself. My heart is in bad shape however (functional and not organic), and circulation is generally disturbed. 'There is a general tendency to congestion of all organs, a general functional impairment.' A urinalysis revealed 'no albumin,' but 'waste that should be there.' (Whatever that implies.) There is very slight uterine misplacement but 'pelvic organs are in better condition than ever before.' There is no insomnia, but on the contrary heavy sleep, broken with much dreaming, and general sleepiness all day. Dr. —— has forbidden meat, tea, or stimulants of any kind; and advises plenty of fresh air, but 'little walking and no stair climbing for a while.' "

I was at first completely in error as regards the cause of this girl's many and real symptoms. She had had many different oculists who prescribed the worst possible lenses and I too hastily jumped to the conclusion that as in so many thousands her

troubles were due to wrong glasses. The following were some of [105] the corrections which had been ordered:

1. B. E. + Cyl. 0.75 ax. 90.
2. B. E. — Cyl. 1.00 ax. 180.
3. B. E. 1° Prisms, Bases in.
4. + Sph. 1.00 D for near work.
5. R. + S. 0.25 — Cyl. 1.75 ax. 175°.  
L. + S. 0.25 — Cyl. 1.50 ax. 15°.
6. R. + S. 0.50 — Cyl. 1.50 ax. 170°.  
L. + S. 0.50 — Cyl. 1.50 ax. 10°.

I found her static error to be:

$$\begin{aligned} R. - S. 0.12 + \text{Cyl. } 0.37 \text{ ax. } 80^\circ &= 20/30. \\ L. + \text{Cyl. } 0.37 \text{ ax. } 110^\circ &= 20/30. \text{ Orthophoria.} \end{aligned}$$

But this correction brought no more relief than did the ludicrously wrong ones, and a second visit some months later was required to learn that the bad corrections and no correction, although making the patient's symptoms worse, were not wholly at the bottom of the mischief. Fading and fluctuating image was the indication of the source of her misery. In about eight or ten seconds this extinction takes place with either eye, singly, and in about twelve seconds for both together. A few minutes reading brings on headache, and an unendurable irritability arises. Her photophobia is increasing, but she has never liked light, always wanted to get in shaded places, under low lights, etc. Even bright colors have always been disliked. The greater the illumination the quicker the image fades. Inquiry brings out the fact that she has known of this fading out of the thing looked at for seven years. The only good my glasses had done was to bring the visual acuteness for a few seconds at a time to normality. The ophthalmoscope showed strong venous pulse in the right, intercrossings of the vessels, turgidity of the veins, while the arteries were thin and pale. These conditions were not so marked in the left eye. By my advice the patient resigned her position, which required much reading and writing, as teacher, and for at least one year she is to stop all near-use of the eyes, live out of doors, etc.

CASE IX is that of a highly educated nonhysterical nonneurotic woman aged 32, who was so unable to study as a child that she did not go to school until she was 13 years old. She came to me after consulting many oculists without relief for sick-headache,— "typical migraine," if there is such a disease. These attacks began about ten years ago, the crises of increasing headache, depression, vomiting, etc., occurring every few weeks. There were the usual old well-known accompanying symptoms of partial

[105] anesthesia, especially of the fingers of the left hand (Why is it always the left?) at the crises. She says: "Ordinary doctors called it neuritis or rheumatism but their remedies did no good, while upsetting my stomach." (This ancient nonsense-wisdom will survive, for how many generations? O Rheumatism and Neuritis, how many medical crimes are committed in your name!) [106] I was so hurried at the first visit that I failed to elicit the details of really more important symptoms, and as the "migraine" was the greatest complaint, and as that is the easiest curable of all diseases, I was the more readily negligent of the duty to get at all the details of past abnormalisms. All of her oculists had given her low spherical lenses alike in both eyes. One had been guilty of cutting the tendons of both interni. The "migraine," of course, continued. There has not been a sign of it since I ordered proper correction of the compound hyperopic astigmatism and subnormal accommodation, and the restored general health and happiness has been shown in an abundant gratitude. But in a few months came complaints by letters that reading, writing, etc., were almost as impossible as before, and a second journey again brought her to my office, when a more perfect case-history and a few tests brought a solution of the mystery.

During girlhood and in more recent years she has often swooned or fainted, sometimes losing consciousness, probably for considerable periods of time,—she was found, *e. g.*, on the floor by her sister in this condition during the night. She remembers now that as early as this, "objects disappeared from view" while looking at them. For instance, at church and while looking at the minister, she would find she could not see him,—"he faded out," etc. Her eyes are in constant movement, shifting, lifting, winking, etc. She has never analyzed or made definite this phenomenon, but for many years she has found that in reading she has to move the book about, constantly shifting it up or down, etc., indescribable dimness or indistinctnesses occurring all the time. This was especially necessary in studying German owing, as she discovered, to the formation and shapes of the letters. She remembers that when under the care of one oculist ten years ago "he was almost driven to distraction because she could not answer his questions." The test letters would be clear for an instant and then blur up. When I was testing her vision this was also painfully evident and as had long been habitual with me, I kept her closing the eyes every few seconds, and then by opening the eyes refixing the letters with the clearer vision gained by the darkening of the retina. She herself taught me a device whereby I could alone secure the proper discrimination: trying one 0.25 addition (or subtraction), or changing of the axis of astigmatism,

by a glance at the letters, and after a second's closure, trying the [106] reverse lens, or axis.

She has a long S spinal curvature, dorsoleft, lumbar right, with difficulty in bending the trunk to the left, with characteristic kinkings of the lumbar vertebræ, etc.

A peculiar photophobia has always existed and is so highly significant, and is so frequently present in these cases, that it deserves marked attention. Her symptoms have all been worse in summer, and any sunlight, glare, or brilliant artificial light, has been repugnant and if not avoided, brought on pain in the eyes, or headache. She has exceptionally large pupils and her husband has noticed that their increased dilatation is a "danger signal" preceding headache, etc. The pain in the eyes, usually the left, has been at once lessened or stopped by darkness or wearing a blinder. She can see better in a dim light; she has kept the lights turned low in her rooms at night; and has always read with the shadow of her head, etc., on the book. She has long had her room heavily shaded, papered with dark wall-papers, etc.

Many tests, each made after closure of the lids, show that the image of a test-letter is held about four seconds with the right eye, and three with the left, and with both together only about four.

At the first visit I made doubly emphatic notes of the existence of very small and pale retinal arteries and capillaries, but at the second visit I saw why this was so. There were abnormally numerous crossings of the vessels, on and near the discs, the threadlike arteries lying almost always beneath the relatively overfilled veins. There was no venous pulse. It was evident that the maculæ and adjacent regions were very poorly supplied with arterial blood. In spite of all this the visual acuteness was for two or three seconds perfect. There was almost no change in the refraction-error between the first and second visits.

It was plain to me and I made it so to the patient that there must be as nearly a perfect renunciation as possible of reading, writing, sewing, etc. Fortunately, although pitifully against taste and habit, this is possible. Had she been a seamstress, clerk, teacher, etc., the tragedy would have been far greater.

CASE X.—Nineteen years ago I prescribed spectacles for a young man with the desired relief of headaches, etc.; but ever since there have been puzzling continuances and recurrences of other symptoms I had supposed due to eye-strain. All the changes and devices I could suggest have never been satisfactory either to myself or my patient. Even before I had recognized the significance of the symptoms of venous pulse, fading images, etc., before I had supposed they had any significance, I had noticed "fluctuating images," variable refraction, inexplicable ambly-

[106] opia, with return of normal acuteness, switching of axes, "asthenopia," an alarming development of myopia, followed by a speedy recovery from it, etc. The headaches I had long been able to conquer, but not these other symptoms. In all such cases I have been habited to send for the patients to whom I had failed to give satisfaction in order to re-examine the refraction, to test for subnormal accommodation (this patient had it), to look for spinal curvature, secure urinalyses, etc. All of which in this case were resultless. So when I had got a clear idea of Ophthalmovascular Choke, I at once sent for this man. It took only a few minutes to find what I had so long overlooked—all the distinctive symptoms of the disease conjoined. The image faded out in three or four seconds with either eye or with both together; there was frequent constant closing, "batting" or "blinking" of the lids,—more decisively and longer held than in winking; rubbing of the eyes, "watering" of the same, photophobia, etc.; there was inability to read or write but a very short time and that with discomfort and "nervousness," or tiring; and there was the necessity of constant movements of the book, etc. Another symptom was new and startlingly suggestive: if reading was forced the book was held to the right side, and finally so far, that the left eye could not see the page; only the nasal side of the right retina was then used, and the macula region was disused. A glance with the ophthalmoscope made it all clear,—there were the unmistakable proofs of vascular choking. The veins were highly distended, and overfilled with dark blood, and there was a long and labored venous pulsation in both eyes. The crossings over each other of the vessels, on and near the discs, and sharp bendings showed sufficiently numerous and severe obstructions to the flow of the venous blood, to account for the symptoms even without the venous pulses or retrobulbar choking. This patient's circumstances were such that he could follow the advice to do no "near-work," at least for a while. I had not the heart to tell him of my belief that he would never be able to read much or any.

*These findings*, taken as a whole, seem to me to constitute a new and clearly-defined type of ophthalmic disease; to throw a flood of light into the pathogenesis of many ocular diseases hitherto seemingly unrelated, and of unknown origin; to differentiate a source of eye-strain until now unsuspected; and to explain a large number of vague but still most real systemic "nervous" and mental disorders. As is well understood, the higher, more complex, more neurologic or cerebral the function the greater must be the supply of fresh blood, the more imperative the necessity for quick elimination of the venous blood. Slight denutrition is decidedly weakening,

and much of it is fatal. Nowhere can it be more harmful [107] than to the astonishingly complex and highly differentiated tissues of the macula region of the eye. At its best and most perfect these parts are with difficulty fed by the nearby but not entering capillaries. Not to be overlooked is the fact also that the function of the rods and cones here is in such an amazing state of unstable equilibrium and has to respond to a force millions of millions times more slight, for instance than the ear.

*The anatomic and physiologic mechanism* of the macular blood-supply is moreover subject to noteworthy difficulties and dangers. If in spraying one's lawn the hose gets curved upon itself the "pressure" or supply of water is lessened. In animals with divergent axes of vision of the two eyes there is not the curving of the retrobulbar optic nerves as in man. With him there is for the first time in evolution not only parallelism of the axes, but in a "near-worker" there is actual and habitual convergence. The greater the approach to parallelism the greater the curving of the optic nerves, and the more convergent the axes, the more the reading, writing, etc., done, the higher is the curve of the orbital portion of the optic nerve. Supposing that when straight, the retinal vessels within the optic nerve had plenty of room, it is evident that their lumens would prevent free transmission of the blood just in proportion to the degree of the neural bending or curvation. It is possible that this cause may act in this way to lessen the proper income and outgo of the two kinds of blood.

But when one thinks of the size of the optic nerve made up of 425,000 strands of insulated fibers it is seen that the vascular trunks in the center of these fibers have little enough room for the blood to pass freely, and that the least crowding may readily interfere with it. Venous pulsation, heretofore considered as wholly without significance, is however an abnormalism, is evidence of a function which either is or may be in itself pathologic. It is plainly a demonstration of "choke," showing that the outflow of venous blood from the eye-ball is irregular and difficult. It is, I suspect, due to crowding of the vessels in the optic nerve and may therefore be differentiated as *retrobulbar choke*. That the retinal in-

[107] *Infrabulbar* arteries have no pulse-beat seems in itself proof of some vascular compression in the nerve, and an added one is the fact that sometimes the venous blood can escape only between the posteriorly placed beats of the artery.

*Infrabulbar choke* may possibly be a simple or secondary consequence of retrobulbar choke, through the added pressure in the arterial blood columns to force an entrance, and through the resultant venous turgidity and impeded outflow of the venous blood. But if there is a plainly added pathogenetic factor easily demonstrable by the ophthalmoscope, and, from the evolutionary history and from the physiology of the eye, most likely to occur, then we have a doubling of two possible pathogenetic agencies which will easily become really denutritional and disease-producing. Such a cause is that found in the ten cases above reported,—crossing of the vessels over or under each other, with resultant impeding of the flow of the blood-currents.

*The pecten, and the shading mechanisms of the retina* must be considered to make clear how and why these infrabulbar chokings have arisen. I do not know that any one has suggested a function or *raison d'être* for the pecten in birds. It could scarcely be a "mistake of Nature," or a mere curiosity for a true scientific man. The danger to the retina of man from direct exposure to the sun's rays is of course well known. Even as little as he need to expose his eyes to these rays in the labors, games, or wars of life, Nature has found it necessary to supply the retina with more than a dozen distinct, ingenious, and differing mechanisms elsewhere described by me, for shading the retinas. But in animals by their habits necessarily exposing the retinas to the danger of direct sunlight, some of these mechanisms do not exist, and all would, in the birds, be insufficient to prevent retinal injuries from this source. Waving about freely and extensively in front of so large portions of the funduses of the eyes of birds the pecten admirably serves as an ever-moving and protecting curtain. The constant motion of the head and eyes keeps up the alternate shading and exposure of the retinas that is required. Anatomically it is a loose mass of blood-vessels. In the higher vertebrates and man it is not needed, and, as it were, becomes

thinned and flattened out forming the fixed single layer or [107] network of arteries and veins, thus giving more extended areas of functional retina; and other shading mechanisms have also replaced it in function. In this retrenchment, flattening, and immobilizing process, and aided by other evident factors, it is but natural that intervascular crossings should occur with resultant pressure on the underlying vessel, diminution of its lumen, impeded flow of blood, etc.,—in a word, what I have called “infrabulbar choke.” When the functional interference may become pathogenic and beget morbid denutrition of the difficultly nourished macula, is a question purely of circumstance, condition, and clinical demonstration. The *fading image* appears a natural consequence and symptom, and once put on our guard and made watchful for it, its clinical appearance is easily recognized, and of far-reaching significance.

*Some practical lessons and cautions* may be gleaned even from these ten cases: The fading image in each eye singly, demonstrates that it is not due to muscular imbalance, and a number of other tests make this clearer; one must be on his guard against confounding this symptom with that due to long-continued eye-strain, from uncorrected, or what is worse perhaps, badly corrected ametropia. In amblyopia *per se* the symptom may be found or rather simulated, but is easily differentiated if care is exercised and the entire case-history is meticulously followed and coordinated with the existing symptom-complex. There is no excuse for the lessening of the exquisite care and conscientiousness required to eliminate the more frequent and common eye-strain, for proper glasses usually lessen the evils of the vascular denutrition, and relieve the symptoms heretofore ascribed to it, while, also, that may be the sole means of making life happier and possibly endurable; subnormal accommodation must also be looked sharply after, and solicitously excluded or allowed for; the time required for the fading must be measured for each eye [108] singly and for both together, and the results compared with the usually corresponding anatomic and functional conditions as shown by the ophthalmoscopic examination of each eye-ground,—for, as everywhere else, and particularly here, there

[108] is no "typical case," individualism being peculiarly emphasized in this disease; in conjunction with the fading image, the existence of objectively observable vascular choking, and more surely if with venous pulsation, there can be little doubt of the existence of this sad disease. Two profoundly suggestive symptoms may have been overlooked in some of the foregoing cases in which I have failed in the recording, but that swoonings or fainting attacks were strangely marked in five, and a notably peculiar photophobia in two, arrests the attention. They are natural results of the deficiency of blood-supply to the macular regions. The effect of this disease upon the cerebral and mental processes, upon the disposition, the occupation, upon a host of evervarying conditions called "nervous," upon "hysteria," "neurasthenia," and the like, is startling in illumination. The transcendent importance of clear and healthy vision to the success and happiness of life should be unquestioned. A cause that cuts it off or impairs it every few seconds is of vast import. The function of vision, never to be renounced, ailing and fluctuating every minute, never to be cured or even understood, add elements of pitiless mystery and despair aptly fitted to induce psychic disease or neurologic morbidity. The inane and fatuous explanations so fashionable with neurologists, "neuropathic tendency," "heredity," "autotoxemia," etc., will not be ended perhaps for a generation, but the study of such cases as these should with genuine clinical knowledge sign their death-certificates in 24 hours—at least so far as pertains to patients with eyestrain or ophthalmovascular choke.

May not this disease explain some or many cases of the development of acute myopia? It supplies the precise condition which would seem required. And of otherwise mysterious and sudden changes in the amounts of myopia, or in the axes of astigmatism?

Just in proportion as the various single symptoms and signs mentioned are united with others, just in proportion to the number conjoined in a single case, will the disease approach "typicality." In order of their importance these may be enumerated as:

#### SUBJECTIVE.

1. The fading image,—according to the number of seconds [108] the image is held, with each eye singly, and with both co-operating.
2. Inability, with all the best ametropic corrections, to read, write, sew, etc., except for an abnormally limited time.
3. Constant changes required in the position of the book, paper, etc., with frequent looking away from it, ceaseless ocular movements, and even reading with some extramacular portion of the retina.
4. Exaggerated winking, approaching blepharospasm, the necessity of rubbing the eyes, etc.
5. Photophobia, conjunctival hyperemia, smarting, sensitiveness, excess of tears, etc.
6. "Nervousness," restlessness, with many, often vague, psychic, and cerebral symptoms, becoming under circumstances more severe and indescribable or even "hysterical."
7. The existence of one or more of these subjective symptoms in one eye, or in both, in conjunction with a corresponding degree of objective vascular choking.
8. Unaccountable refraction-changes, the acute development of myopia, etc.

#### OBJECTIVE.

1. The existence of such crossings, crowdings, obstructions, sharp turns, etc., of the vessels, on or near the discs, as may prevent the free passage of arterial blood to the macular region, or of the venous blood out of the eye.
2. Abnormally enlarged and engorged veins, or abnormally small or thin arteries.
3. Vessels manifestly collapsed, or partially empty after such crossings, obstructions, crowdings, or chokings, in the direction of the blood-currents.
4. Venous pulsation.
5. Abnormal stippling, or pigmentary changes at or about the macula, not to be accounted for by other causes.

The prognosis, it must be admitted is not the brightest, but several important things may be said of it:

[108] 1. We know nothing about what changes or modifications in the disease are wrought by presbyopia, which, as it lessens the intraocular pressure, switching plus astigmatic axes to 180, etc., may bring lessening of the choking. Massage of the globes of the eyes does not seem of much avail. I am going to try the effect of long-continued instillations of weak eserin solutions.

2. Most patients require nothing more than abstention from reading, writing, etc., to secure comparative comfort and happiness.

3. The recognition of the inobviable commands of fate and limits of circumstances is infinitely better than the fright and horror of a fatality, whose nature is unknown, and beyond forecast of how, when, or where, it will strike.

4. On the part of the patient the recognition makes definite and orderly the direction of the life, whereas at present how many thousands are wandering from doctor to doctor, from sanitarium to sanitarium, now filled with hope then in the misery of despair, never well and never dying. With this knowledge the plagued patient may learn the essence of all life-wisdom—to make a friend of fate, *i. e.*, to learn the uses of his limitations, and to stop banging his head against the walls of destiny.

5. On the part of the profession it would be far better to know the real source of the suffering of so many patients, now dubbed by a dozen silly words, "toxemia," "neurasthenia," "hysteria," "invalidism," "break-down," "neuropathic dia-thesis," etc. Those physicians may be checked who are deluding these victims throughout their pitiful lives, knowing medicine cannot cure, but knowing as well that the patient

[109] can pay well for the delusion that medicine will cure. On the part of the conscientious physician or oculist, it is better to know what is the cause of the nagging mystery, to know at least that it is not due to improper glasses, muscle imbalance, or the need of Mrs. Eddy.

6. The "cures" of Mrs. Eddy and the faithcurists, are often seemingly real, because the diseases cured are often due to eye-strain, and ophthalmovascular choke. When the cure is apparently real, it is because reading, writing, etc., are

stopped. Intellect and literature are not needed by the [109]  
Eddyite.

*Ophthalmic vascular choke*, if so much is admitted and becomes established, may be found to constitute the etiologic factor, or at least a frequent and chief one, in the rise of many ocular diseases now veiled in mystery. It is remarkable that we are in more or less complete ignorance of the origin of so large a number of the principal intraocular diseases. The pathogenesis of most, in truth, is either unknown, or erroneously ascribed to vague and non-explaining conditions. Take all the entire classes of diseases characterized by pigmentary and atrophic degeneration of the retina both central and peripheral; they are preceded usually by stages of acute inflammatory processes, followed by atrophies precisely as one would expect to find in a shutting off of the normal blood-supply. There are islets of preserved retinal sensibility; the central or macular portions may keep their function better, or the peripheral ones may do so; the normal central acuteness may be well or poorly sustained, etc., according to the circumstances and accidents of the nature of the choking; or, as in our cases, the sensibility may be retained more or less perfectly but only for abnormally short spaces of time. I suspect that in most or all of the cases by the anatomic pathologists called retinal arteriosclerosis, ophthalmovascular choke is the real disease instead of primary sclerotic changes in the vessel-walls.

That elder choking called *choked disc*, together with many mysterious cases of optic atrophy,—may not these and many retinitis be caused by a bad blood-supply, or, what is the same thing, a deficient blood excretion? The great mystery of the origin of glaucoma may be at last resolved by weighing well the natural and inevitable consequences of vascular choke. The ludicrous inadequacy and ineptitude of the textbook etiologies of glaucoma, illustrate—well, they illustrate “much.” Exophthalmic goiter with its chief symptoms, tachycardia and exophthalmos, may possibly have a primary, or at least a cooperating cause in the denutrition and abnormalities of secretion following a deficient blood-circulation of the internal parts of the eye.

